

## PATENT SPECIFICATION



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## PROVISIONAL SPECIFICATION.

## Improvements in or relating to the Fitting of Liners to Cylinder Bores.

We, CECIL FRANCIS SIMMONDS, a British Subject, of Sheepbridge Works, Chesterfield, Engineer, and SHEEPBRIDGE STOKES CENTRIFUGAL CASTINGS COMPANY, LIMITED, a British Company, of Sheepbridge Works, Chesterfield, do hereby declare the nature of this invention to be as follows:—

This invention is for improvements in or relating to the fitting of liners to cylinder bores of engines, pumps, compressors and the like and to the type of liner known as a "dry" liner, that is to say, a liner of which the outer surface is arranged to contact with the inner surface of a cylinder wall in which the liner is fitted.

Hitherto liners of this character have usually been fitted to cylinder bores by machining the liner to an external diameter slightly larger than the inner diameter of the bore, in which it is required to fit. The difference in these diameters is known as the "interference fit" and ensures that when the liners are pressed into the cylinder bores, they are held in position by virtue of the radial wall pressures in the cylinder wall and liner due to the stresses set up by the interference fit. It is usual to provide such liners with a flange at one end which is arranged to fit into a recess machined in the cylinder bore and acts as an additional precaution against longitudinal movement of the liner relatively to the cylinder wall. The flange usually provided is of relatively short length in comparison with the length of the liner and is not provided with an interference fit.

This type of liner is found to be unsatisfactory when fitted to internal combustion engines in which the flange of the liner is required to withstand the forces due to the power explosions in the respective engine cylinders.

According to this invention, in a method of fitting a dry liner to a cylinder bore, the outer surface of the liner is provided with a step or steps formed

longitudinally of the liner, for example, one step arranged to extend from the base of the liner for less than half the total length of the liner (preferably 10% to 15% of the said length) and so arranged as to permit the liner to be pressed into the cylinder bore which is machined to receive the step of the liner and to form an interference fit therewith.

The stepped formation of the liner and cylinder bore effectually prevents longitudinal movement of the liner relatively to the cylinder bore, whilst in the case of an internal combustion engine, the step is relieved of all strain due to the forces of the explosion in the cylinder.

A typical example of carrying the invention into effect is as follows:—

A cylinder liner made of cast iron, alloy cast iron or steel of 4 inches bore and 10 inches in length is machined for a distance of 9 inches from its upper end to an external diameter of  $4\frac{3}{16}$  inches + 0.002 inch, and the lower portion of the liner which is 1 inch long is machined to an outside diameter of  $4\frac{3}{16}$  inches - 0.008 inch. The cylinder bore in a cylinder block of cast iron, alloy cast iron or steel is machined for axial lengths thereof in accordance with the lengths of the stepped portions of the liner and to an upper diameter of  $4\frac{3}{16}$  inches and the lower diameter of  $4\frac{3}{16}$  inches - 0.010 inch. The differences in the respective outer diameters of the liner and the internal diameters of the cylinder bore provide the required interference fits which ensure that the liner is firmly secured within the cylinder bore when pressed therein, for example, by means of a hydraulic press or other means.

Dated this 11th day of March, 1932.

G. F. REDFERN & Co.,  
15, South Street, London, E.C. 2,  
Agents for the Applicants.

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## COMPLETE SPECIFICATION.

## Improvements in or relating to the Fitting of Liners to Cylinder Bores.

We, CECIL FRANCIS SIMMONDS, a British Subject, of Sheepbridge Works, Chesterfield, Engineer, and SHEEPBRIDGE STOKES CENTRIFUGAL CASTINGS COMPANY, LIMITED, a British Company, of Sheepbridge Works, Chesterfield, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:

This invention relates to the fitting of liners to the bores of cylinders of engines, pumps, compressors and the like and refers to the type of liner known as the "dry" liner, which is a liner of which the outer surface is arranged to contact with the inner surface of the cylinder wall in which the liner is to be fitted.

Hitherto, liners of this type have usually been machined to an external diameter slightly larger than the bore diameter of the cylinder into which the liner is to be fitted, and in fitting the liner, the latter has generally been forced into the cylinder bore against the difference in the diameters of the liner and bore, this difference, which is known as the "interference fit", serving to ensure that the liner, when once introduced into position in the bore, will be self-held therein by reason of opposed radial pressures in the cylinder wall and liner due to permanent stresses set up therein by the interference fit.

In order, however, to ensure still further against longitudinal displacement of the liner from its proper position within the cylinder bore, liners of the type referred to are frequently provided at one end with flanges arranged to fit into corresponding recesses machined to receive them in the cylinder bore, such flanges being of relatively short axial length in comparison with the total length of the liner and being provided with a plain non-interference fit with said recess.

It is a difficulty with liners of this type, especially when they are fitted into the cylinders of internal combustion engines, in which case the flange of the liner has to withstand the forces due to the power explosions in the cylinder, that the liner will frequently fail to stand up to the stresses exercised in it and will split or crack, with consequent loss of

compression and engine power.

The object of the present invention is to provide an improved form and method of fitting of cylinder bore liners of the type referred to, wherein this difficulty will be avoided.

According to the present invention, a dry liner for a cylinder bore having an interference fit with the bore is formed with a portion of substantial length (for example, from 10—40% of the total length of the liner) of its peripheral surface at the base end thereof of slightly less diameter than the remainder of said surface, the cylinder bore being correspondingly shouldered to lock with the liner against endwise displacement thereof.

The stepped formation thus of the liner and cylinder bore has been found effectual to prevent axial displacement of the liner relatively to the cylinder bore and in the case of the cylinders of an internal combustion engine, the stepped portion of the liner is not subjected to excessive strain due to the explosion forces in the cylinder.

It has been proposed to line the bore of the pressure cylinder of a vertical hydraulic press with a bush of electrolytic copper or a like dense metal, the bush being of shouldered formation externally and the bore of the cylinder receiving it of correspondingly stepped form to interlock with it. The present invention, however, is concerned solely with cylinder liners having interference fit with the cylinder bore, in the sense in which this term is used herein as indicated above.

A typical example of how the invention may be carried into effect will now be described with reference to the accompanying drawings, of which Figure 1 is a diagrammatic representation of the improved liner and Figure 2 of the cylinder bore to receive it, but it is to be understood that this example is given herein purely for purposes of illustration and that the actual dimensions cited may be departed from according to requirements in any given case.

A cylinder liner 1 made of cast iron, alloy cast iron or steel of 4 inches bore and 10 inches in length is machined for a distance of 9 inches from its upper end to an external diameter of  $4\frac{1}{16}$  inches + 0.002 inch, and the lower portion 2 of the liner, 1 inch

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long, is machined to an outside diameter of  $4\frac{3}{16}$  inches - 0.008 inch. The cylinder bore 3 in a cylinder block of cast iron, alloy cast iron or steel, is machined for axial lengths thereof in accordance with the lengths of the stepped portions of the liner and to an upper diameter of  $4\frac{3}{16}$  inches and a lower diameter of  $4\frac{3}{16}$  inches - 0.010 inch. The differences in the respective outer diameters of the liner and the internal diameters of the cylinder bore provide the required interference fits which ensure that the liner is firmly secured within the cylinder bore when pressed therein, for example, by means of a hydraulic press or other suitable means.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:

1. A method of fitting dry liners to cylinder bores with an interference fit between the liner and the bore according to which the liner is formed with a portion of substantial length (for example, from 10—40% of the total length of the

liner) of its peripheral surface at the base end thereof of slightly less diameter than the remainder of said surface, the cylinder bore being correspondingly shouldered to lock with the liner against endwise displacement thereof.

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2. The subject-matter of Claim 1, wherein the two portions of different diameters of the peripheral surface of the liner and correspondingly the two portions of the cylinder bore in which the liner is received are both machined substantially parallel to the axis of the liner and bore.

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3. Dry liners machined with a reduced peripheral surface for fitting into a correspondingly formed cylinder bore in accordance with the method claimed in Claim 1 or Claim 2.

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4. A cylinder bore, more especially of an internal combustion engine, lined with a dry liner as claimed in Claim 3.

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Dated this 19th day of October, 1932.

G. F. REDFERN & Co.,  
Chartered Patent Agents,  
15, South Street, London, E.C. 2,  
Agents for the Applicants.

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Fig. 1.

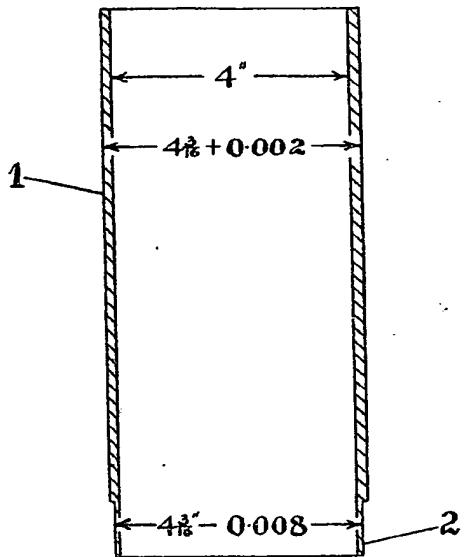
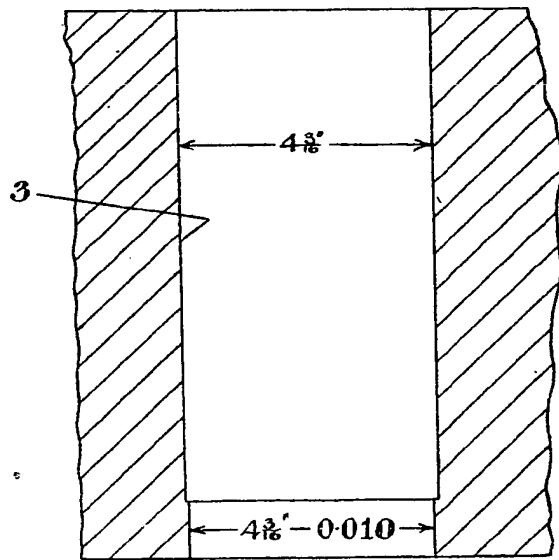


Fig. 2.



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